

# Office of Environment and Energy's (AEE) Air Traffic Management Modernization / Operations Research Program Update

Presented to: REDAC E&E Subcommittee  
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Federal Aviation  
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# Air Traffic Management Modernizations (ATMM) Offer Important Potential E&E Improvements

## AEE E&E ATMM Research Program Goals

1. *Identify and accelerate the implementation of air traffic management concepts that will reduce aviation environmental impacts and/or improve energy efficiency*
2. *Investigate the E&E effects of operational changes implemented by the FAA.*

## Core Program Elements

- *Research Process: Identifies, conducts, evaluates and transitions ATMM research for implementation*
- *Roadmap: Describes areas for ATMM Research near, medium, and long term.*
- *Portfolio Metrics: Assesses the portfolio's balance with regard to addressing E&E issues and the maturity progression of research project.*



Focus Area	AEE ATMM Research Roadmap						Impact Time Frame		Phase of Flight			Environmental Impact (+/-)				
	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016+	Near Term	Far Term	Surface	Terminal	En Route	Air Quality	Climate	Energy	Noise	
Policy Assessment	P43: Phase I Exploration of aircraft mission specification changes ① → P43: Phase II Exploration of aircraft mission specification changes ② → P43: Phase III Exploration of aircraft mission specification changes ① → CLEEN transition							✓			✓		✓	✓		
	End-around taxiway optimization ③ → ATO briefed						✓		✓			✓		✓		
ATM/Operations Exploration and Development	P32: Near-term operational changes ② → Scoping OPC ② → Exploration of climb phase of flight ① → Evaluate potential benefits resulting from OPC use ② → Exploration of steeper glide slopes ①						✓		✓	✓			✓	✓	✓	✓
	Benefits of cruise, altitude, and speed optimization (CASO) ③ → Aircraft Operational Evaluation Analysis - CASO ③						✓			✓	✓		✓	✓		
	Exploration of low power/ low drag → Exploration of Delayed Deceleration Approaches (DDAs) ① → Aircraft Operational Evaluation Analysis - DDAs ②						✓			✓			✓	✓	✓	
	Advanced Ops Noise Modeling (ASCENT) ③						✓		✓	✓					✓	
	P21: Airport surface movement optimization (N-control) ⑥ → P21: Airport surface movement optimization (N-control) ① → P21: Airport surface movement optimization (N-control) ④ → ATO transition						✓		✓	✓		✓		✓		
	Scoping study to identify and evaluate promising concepts ① → Scoping study to identify and evaluate promising concepts ①						✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Benefits assessment of CDQM and ground metering at JFK → P21: Airport surface movement optimization (N-control) ⑥						✓		✓	✓					✓	
	Benefits assessment of PBN integration ② → Interdependencies associated with PBN departure procedures ③ → Explore integration of E&E in PBN development ③						✓			✓	✓	✓	✓	✓	✓	
	P39: Evaluation of the MFAST tool ③ → Benefits of En Route Trajectory Prediction & Control ①						✓			✓	✓	✓	✓	✓		
	Environmental Benefits/ Impact Assessment	Benefits evaluation of ADS-B implementation in the GOMEX region ③ → Dormant; seeking FDR data						✓				✓		✓	✓	
Scope of UAS Benefits Assessment ① → Evaluation of the effects of introducing UASs in the NAS ②								✓	✓	✓	✓	✓	✓	✓		
Evaluation of the tradeoffs between vectoring and speed control ② → ATO/ANG briefed						✓			✓	✓	✓	✓	✓			

■	Projects funded prior to FY14
■	FY14 funded
□	Active Projects
■	Potential future research not yet funded
ⓧ	Concept Maturity Level (higher # = increasing maturity)
A - C	Priority Level



# Drivers of Research

## 1) Support AEE Vision and E&E goals

## 2) External pressures:

- ANG-2 (NextGen Chief Scientist) direction:
  - Will be difficult to fund concepts that don't have a near-term path to implementation
  - New operational concepts need to be either beneficial or neutral in terms of noise
- General prominence of noise issues
- Inconsistent/unpredictable funding, e.g., anticipated FY15 F&E funding cut expected to significantly reduce ops research budget



# How are we aligning AEE Ops Research Program to conform to these pressures?

- 1) Maturing promising near-term operational mitigations with the goal of transitioning to appropriate implementing organization (e.g., ATO, ANG)**
- 2) Noise focus**
  - Noise-beneficial concepts
  - Enhancing noise analysis/modeling of operational concepts
- 3) Developing improved environmental analysis capability**
  - Tools and processes
  - UAS
- 4) Continuing and enhancing collaboration (within FAA and with external stakeholders)**
- 5) Annual Roadmap assessment**



# Maturing Promising Concepts

- **Advance concept maturity to demonstrate environmental/operational benefits and identify potential implementation strategy**
- **Work collaboratively with implementing organization (e.g., ATO, ANG) with the goal of integration into NAS**
- **Concepts adequately funded in FY14 to minimize dependency on FY15 funding**

Project	FY14 Funding
Cruise Alt. and Speed Optimization (CASO) / Delayed Deceleration Approach (DDA)	\$1M
N-Control	\$170K
Optimized Profile Climb (OPC)	\$150K

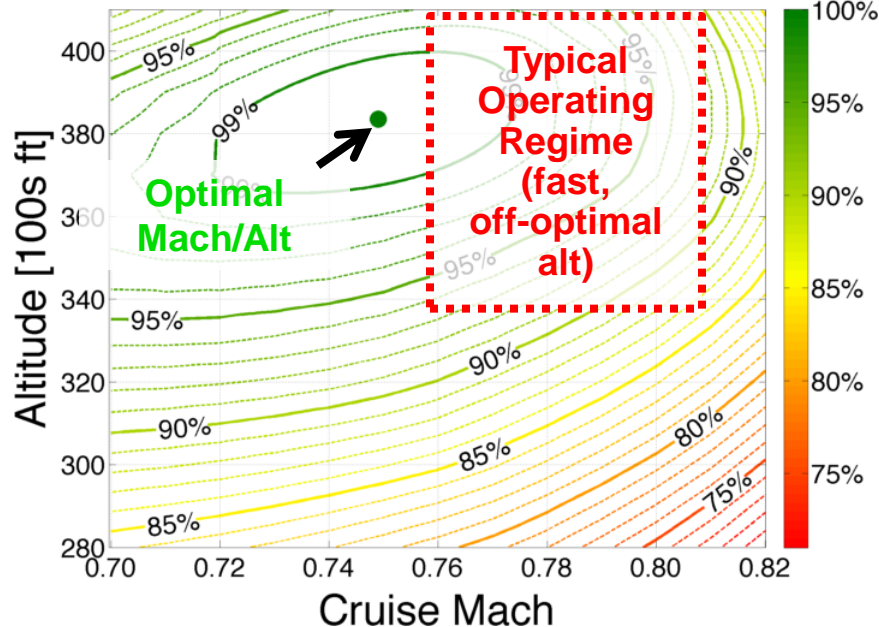


# Maturing Promising Concepts

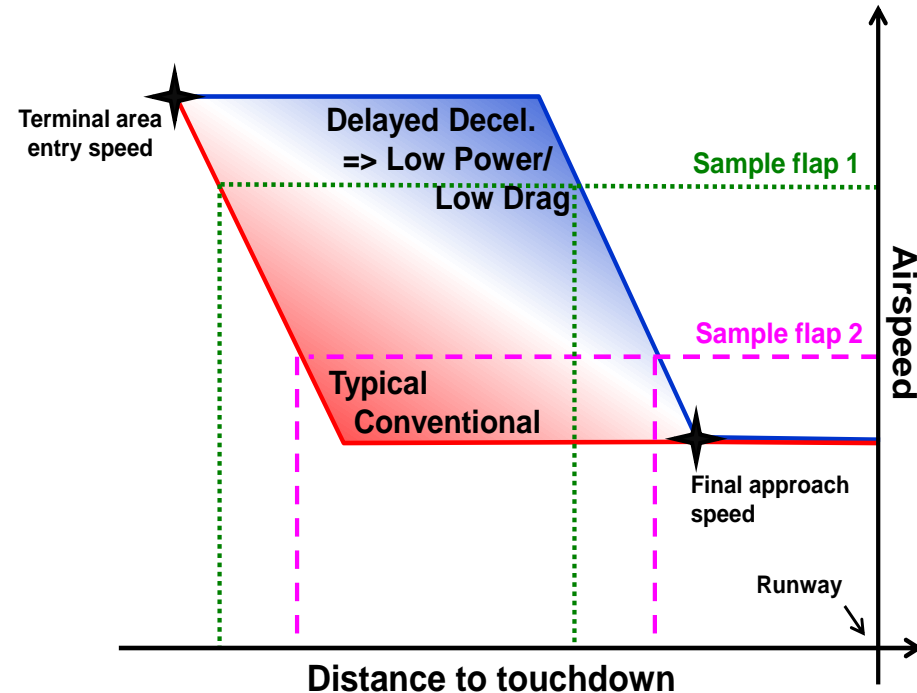
## CASO

Fuel Efficiency (Specific Ground Range)  
Narrow Body Airliner at 50% Useful Load

% Max  
SGR



## DDA



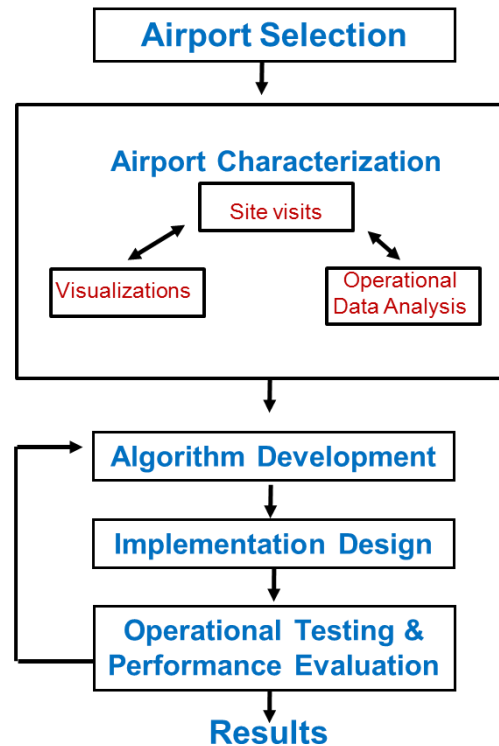
- Benefits fairly well-understood; critical path now is stakeholder collaboration and understanding operational barriers, implementation strategy
- Opportunities with Delta, OSU/NetJets
- Integration into NextGen concepts, e.g., RNAV speed targets



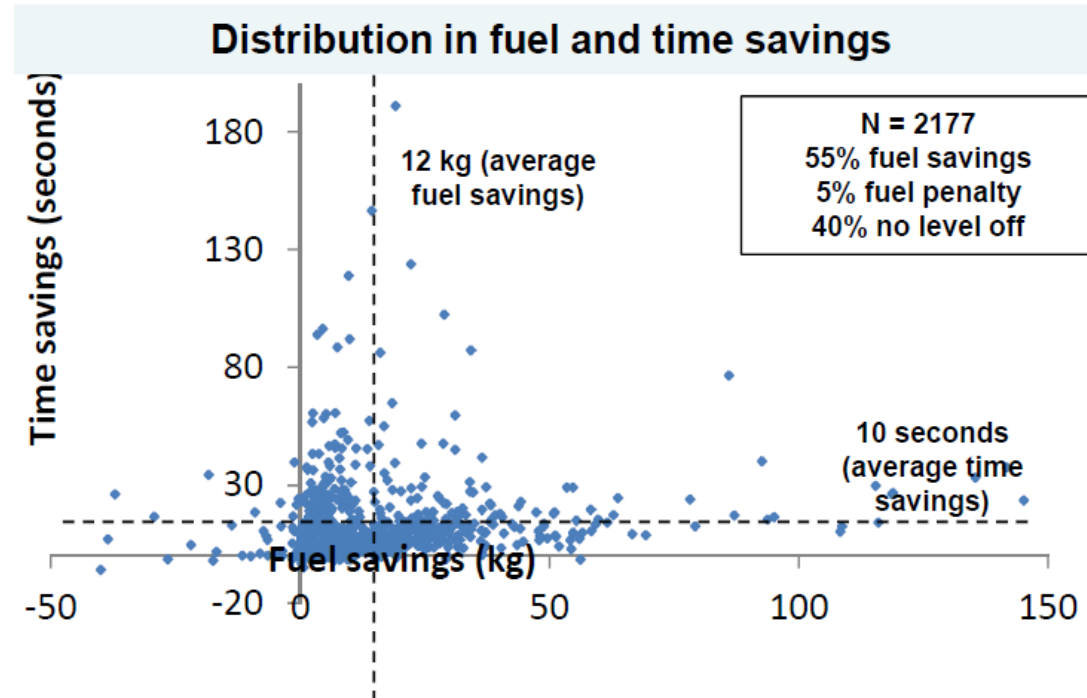
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# Maturing Promising Concepts

## N-Control



## OPC



- Focused on LGA demo and Surface Office coordination
- Complementary to NextGen Integration Working Group recommendation

- Refining benefits estimates
- Identifying barriers and targeted opportunities





# Noise Focus

- **Noise-beneficial concepts:**

Project	Noise Impact	Research Approach
DDA	Potential benefit from staying in “clean” configuration	Exploring noise measurement
OPC	Potential benefit from steeper profile	Exploring alternative metrics/modeling
Steeper glide slope	Potential benefit from steeper approach profile	Possible NAS-wide analysis (not currently funded)

- **Enhanced analysis/modeling capabilities**
  - ASCENT project focused on quantifying noise impacts of advanced operational procedures



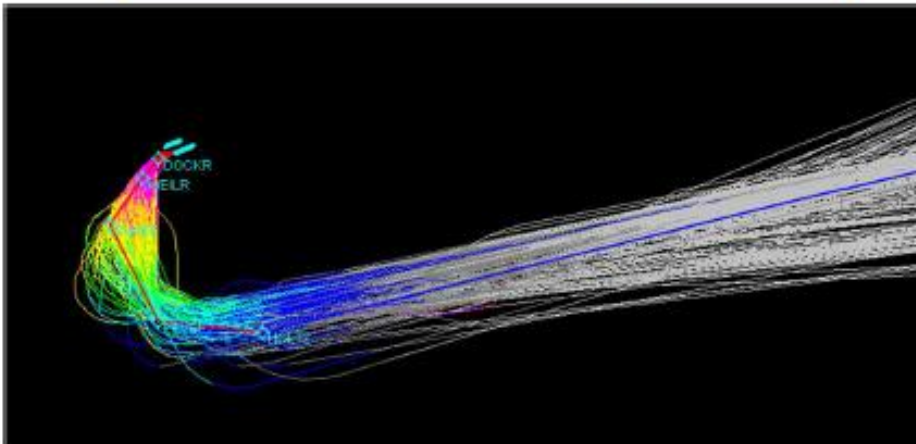
# Improved Environmental Analysis Capability

- **Goal is to perform operations analysis that informs decision-making**
- **PBN Procedures Analysis objectives:**
  - Evaluate E&E impact of PBN procedures
  - Develop generalized approach using AEDT to assess PBN procedures
  - Assess noise and emissions trade-offs associated with Noise Abatement Departure Procedures (NADPs) and explore operationally viable alternatives
- **In addition to E&E assessments, analysis has resulted in development of tools/processes for advanced operations analyses with AEDT**

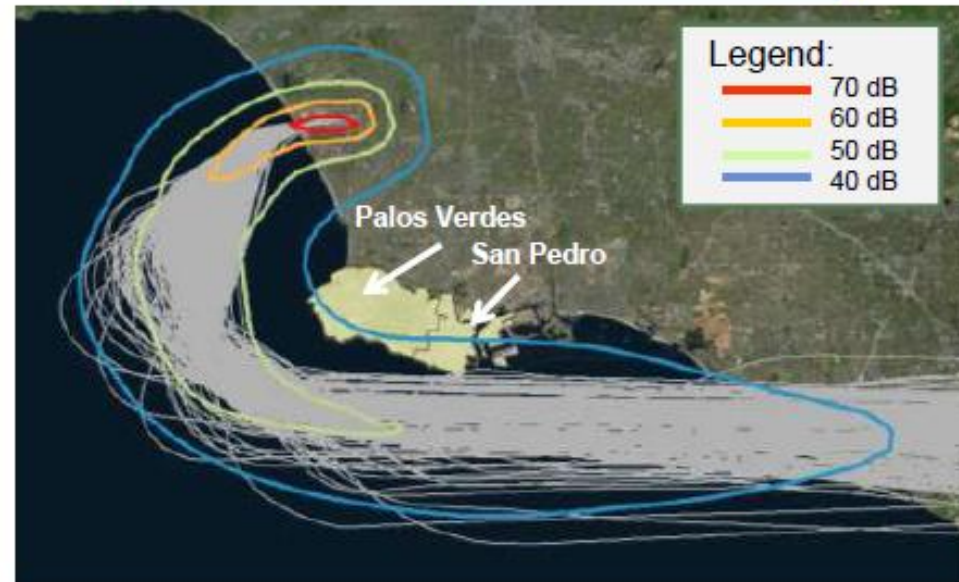


# Example NADP Analysis – LAX

Baseline HOLTZ9 Runway 25R



Baseline Preliminary DNL Noise Contours

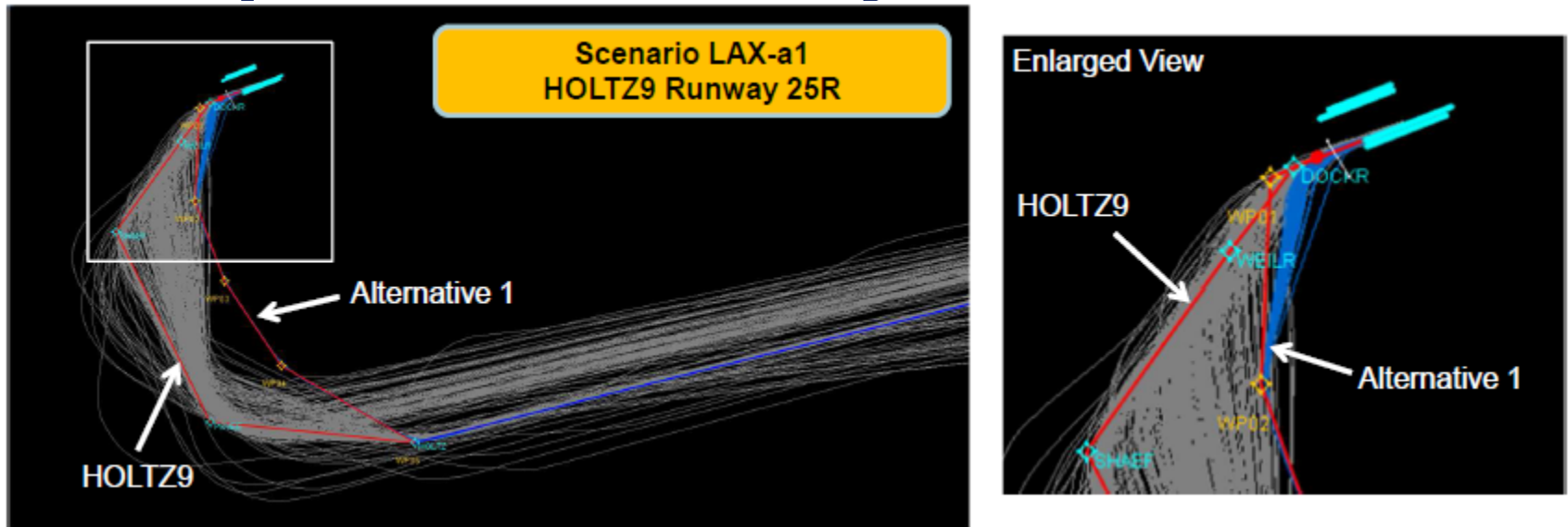


Baseline Preliminary Emissions and Noise Exposure Results

Event	# of Flights	Fuel (kg)	Distance (km)	Duration (min : sec)	CO (kg)	NO <sub>x</sub> (kg)	PM <sub>2.5</sub> (kg)	DNL Contour Area (sq. km)			
								40 dB	50 dB	60 dB	70 dB
Baseline*	693**	2,035	255	23:02	2.3	42	1.9	806	185	21	3



# Example NADP Analysis – LAX

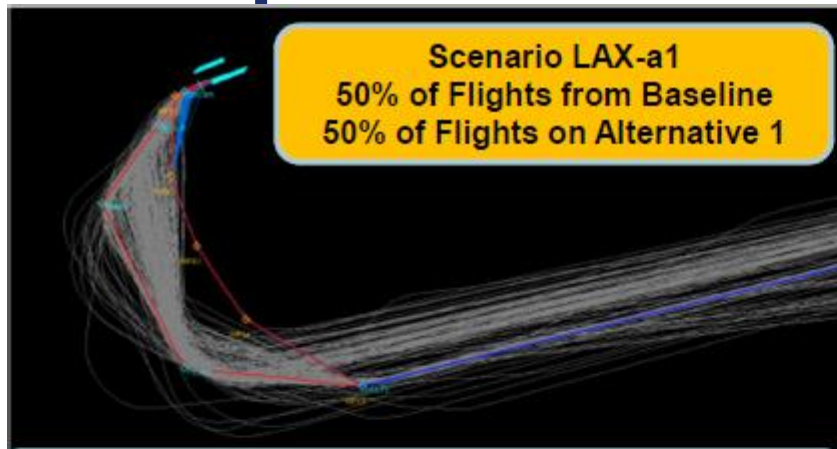


- The scenarios were created to determine the environmental impact of different utilization rates of the Alternatives
- Scenario LAX-a1 Creation:
  - 350 (50%) of the tracks from the baseline sample were used
  - 350 (50%) of the tracks from the baseline sample were 'tagged' onto Alternative 1
    - In TARGETS, control line was drawn across tracks to 'tag' to a procedure
  - Scenario LAX-a1 assumes the same percentages of Day/Evening/Night flights as the Baseline
    - Baseline Day: 231 (38% of total flights)      Alternative 1 Day: 231 (38% of total flights)
    - Baseline Evening: 36 (5% of total flights)      Alternative 1 Evening: 36 (5% of total flights)
    - Baseline Night: 83 (12% of total flights)      Alternative 1 Night: 83 (12% of total flights)
    - Scenario LAX-a1 Total: Day – 462 (66%), Evening – 72 (10%), Night – 166 (24%)



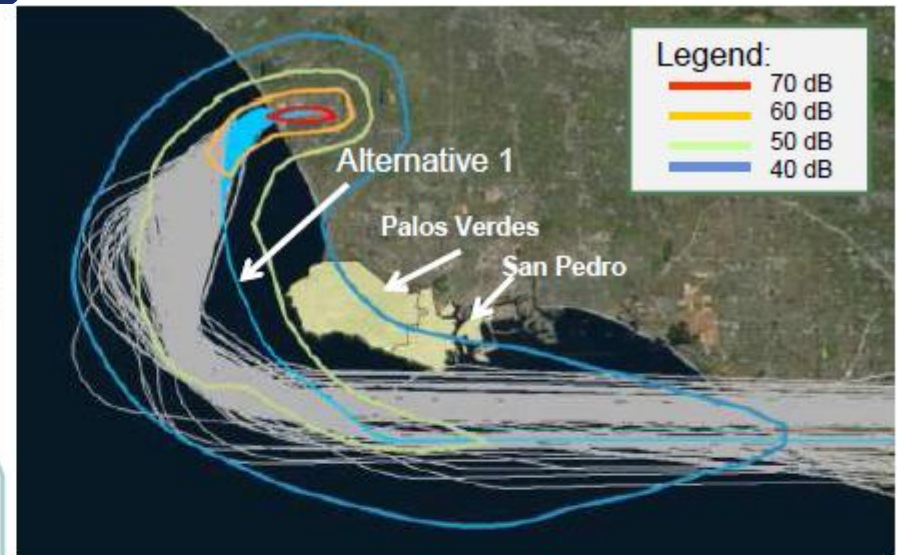


# Example NADP Analysis – LAX



## Key Take-Aways:

- Scenario LAX-a1 results in reductions in fuel, distance, duration, and emissions when compared to the baseline
- The CNEL 60 dB contour areas increased in size, the 50 dB contour area decreased, and 70 dB contour area remained the same.



**Scenario LAX-a1 Preliminary CNEL Noise Contours**

## Scenario LAX-a1 Preliminary Emissions and Noise Exposure Results

Event	# of Flights	Fuel (kg)	Distance (km)	Duration (min : sec)	CO (kg)	NO <sub>x</sub> (kg)	PM <sub>2.5</sub> (kg)	CNEL Contour Area (sq. km)		
								50 dB	60 dB	70 dB
Baseline*	693	2,035	255	23:02	2.3	42	1.9	185	21	3
Scenario LAX-a1**	642	-53 (-2.6%)	-4.7 (-1.9%)	-0:35 (-2.5%)	-0.13 (-5.8%)	-1.43 (-3.4%)	-0.04 (-2.3%)	-38 (-20%)	+7 (+33%)	No change
Δ										

**Preliminary results; do not cite or quote**



# Improved Environmental Analysis Capability

## Modeling Potential E&E Benefits/Impacts of UAS in the NAS

- On-going coordination with:
  - FAA UAS Integration Office
  - Volpe
  - TRB/ACRP
  - NASA
  - DoD
- Preliminary Findings on UAS Customization and Substitution in AEDT

Level of Difficulty	Description of Customization	Data Needs	Data Availability	Updates to AEDT
0	Model UAS conversions as actual AEDT aircraft (e.g. G550 Conversion as a GV in AEDT)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1	Model UAS with a substitute aircraft currently in AEDT	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2	Select an airframe, engine alternative in AEDT	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3	Select an airframe engine alternative with different BADA fuel specifications			
4	Select an airframe engine alternative with a different NPD curve			
5	Obtain new performance data for UAS vehicles and integrate into AEDT (Fuel Burn)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
6	Obtain new performance data for UAS vehicles and integrate into AEDT (Noise)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

**Preliminary results; do not cite or quote**



# Summary

- **AEE Ops Research program is positioned to respond to external pressures now and in the future:**
  - 1) Maturing promising mitigations
    - CASO, DDA, N-Control, OPC
  - 2) Addressing noise impacts
    - Noise-mitigating concepts
    - Enhanced noise modeling/analysis of operational concepts
  - 3) Improved environmental analysis capability
    - Procedure assessment
    - UAS
  - 4) Collaboration
  - 5) Annual Roadmap assessment

